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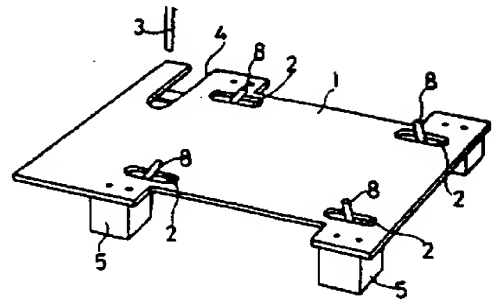
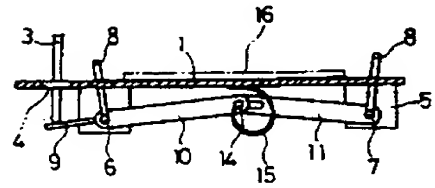
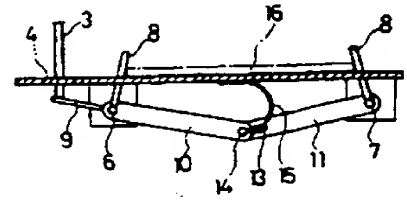
TITLE : CLAMPING DEVICE







ABSTRACT : PURPOSE: To eliminate wafer damages when processing by a method wherein longitudinal holes wherein bar claws for wafer clamping are inserted are provided at four corners of a mout plate whereon a piece of semiconductor wafer is mounted, and arm levers having claws are arranged thereunder which slant claws projected out of longitudinal holes when the mount plate is raised and cause the wafer to be held.

CONSTITUTION: At four corners of a mount plate 1 whereon a piece of semiconductor wafer is mounted, longitudinal holes 2 wherefrom wafer clamping claws 8 to hold the wafer are projected are formed. Besides, a notch 4 wherein an operation bar 3 to correct the operation of arm levers 10 and 11 supporting the claws 8 inserted is provided on one end. A pin 14 is inserted into the joint of these levers 10 and 11, a curved plate spring 15 is wound around this pin, and four claws in all are installed upward at the top end of the arm levers 10 and 11 via axis 6 and 7. In this constitution, when the mount plate 1 is raised, four clamws 8 are respectively slanted to the inside by cooperation of the operation bar 3 and the spring 15 so as to securely hold a wafer.

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⑭クランプ装置

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明　　細　　書

1. 発明の名称

クランプ装置

2. 特許請求の範囲

ウエハーを載置する載置板の裏面に一対の軸を回動自在に設け、これら軸の一方に回動操作部を形成するとともに、夫々の軸に上記載置板に形成した孔から突出するクランプ用爪を固着し、上記夫々の軸に腕杆を挿着し、これら腕杆を連結して夫々の軸を連動せしめるとともに、弾性部材を介して上記クランプ用爪をクランプ方向に付勢せしめてなるクランプ装置。

3. 発明の詳細な説明

本発明はＬＳＩ或いは超ＬＳＩ等の大集積回路を埋設したチップの製造に用いる半導体ウエハーに、現像処理又はエッチングを施す場合などに好適するクランプ装置に関する。

従来から大集積回路を埋設したチップを製造する工程として、半導体ウエハー上のホトレジストの現像或いは半導体ウエハー表面のウエットエッチングをスプレー方式或いは浸漬方式等によつて行なつており、これらの工程を行なう装置も種々提案されている。

また最近では、超ＬＳＩ等の高集積化に伴つて超微細パターンの形成が要求される一方、チップを大量且つ安価に提供すべくウエハーの大口径化が進んでいる。このため本出願人が先に出願した特願昭55-60670号若しくは実願昭54-174906号の如きウエハーを下向きにして連続的に現像又はエッチング処理する装置によつて、上記要望に応えられるようになつた。

しかしながら斯る装置においても、半導体ウエハーに現像処理やウエットエッチングを施す場合にあつて、従来提案されてきたクランプ装置を用いると、半導体ウエハーに傷をつけたり、割れたり、或いは把持が確実でないので半導体ウエハーが落下し破損する等の問題がある。したがつて半導体ウエハーをクランプする装置が未解決の課題として残されている。

本発明者等は上述の如き従来の問題点に鑑み、

これを有効に解決すべく本発明を成したものであり、その目的とする処は、半導体ウエハーに現像処理或いはエッチングを施す際にウエハーを傷つけたり、割つたり或いは落下せしめて破損することなく確実にクランプでき、且つ均一なる現像或いはエッチングを行なうことができるクランプ装置を提供するにある。

斯る目的を達成すべく本発明は、ウエハーの載置板の裏面に、少くとも一方に回動操作部を形成した一対の軸を回動自在に取り付け、夫々の軸に上記載置板に形成した孔から突出するクランプ用爪を設けるとともに、夫々の軸に腕杆を挿着固定し、これら腕杆をピン等を介して連結して夫々の軸が連動して回動するようにし、更に弾性部材によつて上記クランプ用爪をクランプ方向に付勢したことをその要旨としている。

以下に本発明の実施の一例を添付図面に従つて詳述する。

第1図は本発明に係るクランプ装置の全体斜視図、第2図は同装置の要部の分解斜視図である。

図中1は半導体ウエハーの載置板であり、この載置板1は平面略々矩形状をなし、且つ隅部近傍にはその長径方向が載置板の長さ方向と一致した長孔2…を穿設し、更に一側端には操作桿3が出入するための切欠4を形成している。

そして載置板1の裏面の隅部近傍には保持体5…を螺着し、この保持体5…間に第2図に示す如く一対の軸6，7を架設している。即ち軸6，7は夫々その両端部をもつて上記保持体5に穿設した孔5aに挿通され、回動自在に保持されている。

また軸6，7の両側部には棒状のクランプ用爪8…を一体的に取り付け、これらクランプ用爪8…は上半部が上記載置板1に形成した長孔2…から上方に突出するようになつている。そして上記軸6には上記操作桿3と当接することにより軸6を回動せしめる板状の回動操作部9を一体的に取り付け、更に上記軸6，7の中間部には腕杆10，11を基端部をもつて挿着し、軸6，7と一体的に回動するようにしている。

そして、上記軸6に挿着した腕杆10の先端部

にはピン14の挿通用の孔12を形成し、また軸7に挿着した腕杆11の先端部には長孔13を形成し、上記孔12に挿通したピン14をこの長孔13に通すことで、腕杆10，11の先端部相互が回動自在に連結するようにしている。

更に上記ピン14には板バネ15を嵌着している。即ち板バネ15は湾曲板状をなし、下端部をロールして嵌込み部15aを形成し、この嵌込み部15aをもつて上記ピン14に嵌着されるとともに上端部が上記載置板1の下面に当接し、上記ピン14と載置板1との間に縮装されるようになつている。

而して上記腕杆10，11の先端部は板バネ15によつて下方に弾圧され、この結果クランプ用爪8…は夫々クランプ方向に付勢されることとなる。

以上の如き構成からなるクランプ装置の作用を第3図及び第4図に基づいて説明する。

先ず載置板1が上昇してくると軸6に取り付けた回動操作部9の上面が操作桿3の下端に当接する。そして更に載置板1が上昇すると回動操作部

9の先端部の位置はそのままであるので軸6は第3図中反時計方向に回動し、軸6に取り付けたクランプ用爪8はアンクランプ方向に回動する。そしてこの動作と同時に、腕杆10は軸6を中心として板バネ15の弾発力に抗して反時計方向に回動する。更にこの腕杆10と腕杆11は先端部において連結しているので腕杆10の回動につれて腕杆11は軸7を中心として時計方向に回動し、この回動によつて軸7が時計方向に回動する。したがつて軸7に取り付けたクランプ用爪8も同時にアンクランプ方向に回動し第3図に示す如き状態となる。斯る状態において、図示しない搬送手段により搬送されてきた半導体ウエハー16を載置板1上に載せる。

次いで載置板1を下降せしめると、腕杆10，11の先端部は板バネ15の弾発力によつて下方へ押下げられ、これにつれて軸6は時計方向に、軸7は反時計方向に回動し、これら軸6，7に取り付けたクランプ用爪…はクランプ方向に回動し第4図に示す如く半導体ウエハー16を確実に保

持することとなる。

この後載置板1上にウエハー16をクランプしたまま載置板1は約90°回転して垂直状態となり、そのままの状態で図示しない現像槽或いはエッチング処理槽等に入り、更に同一方向に90°回転してウエハーは下向きとなり、このウエハー16に処理を施す。そして現像処理等が済んだならば、前記とは逆の動作により載置板1は上昇し、操作棒3に回動操作部9が当接し、ウエハー16をアンクランプ状態とする。その後搬送装置により洗浄などの次工程へウエハーを送る。

尚以上は図面に示した実施例について説明したものであり、本発明のクランプ装置は上記に限定されるものではない。例えば図示例にあつては、操作棒3を固定したものについて説明したが、操作棒3が上下動することによつてクランプ用爪8にクランプ及びアンクランプ動作をなさしめるようにしてもよく、また図示例にあつては弾性部材として板バネ15を示したがコイルスプリング等でもよく、更にクランプ用爪8の数も任意である。

以上の説明で明らかな如く本発明によれば、半導体ウエハーの載置板の裏面に、一方に回動操作部を形成した一対の回転自在な軸を設け、夫々の軸に上記載置板に形成した孔から突出するクランプ用爪を取り付けるとともに、夫々の軸に先端部同士が連結する腕杆を挿着し、更に弾性部材を介して上記クランプ用爪をクランプ方向に付勢せしめるようにしたので、適当なる弾発力を有する弾性部材を選択することにより、ウエハーを破損することなく確実に保持することができ、また常にクランプ用爪はクランプ方向に付勢されているので現像処理中などにウエハーが載置板から外れる虞れがない。また装置全体として無駄なく合理的であるので、その厚みを可及的に薄くでき、このため現像槽等の入口を狭くしても何ら支障なく現像処理等が行なえる。そして更に装置の交換が容易に行なえるので種々の径の半導体ウエハーに適用できる等多大の利点を発揮する。

4. 図面の簡単な説明

図面は本発明の好適一実施例を示すものであり、第1図は本発明に係るクランプ装置の全体斜視図、第2図は同装置の要部を分解して示した斜視図、第3図はアンクランプ状態にある同装置の縦断側面図、第4図はクランプ状態にある同装置の縦断側面図である。

尚図面中、1は載置板、2は孔、6，7は軸、8はクランプ用爪、9は回動操作部、10，11は腕杆、15は弾性部材、16はウエハーである。

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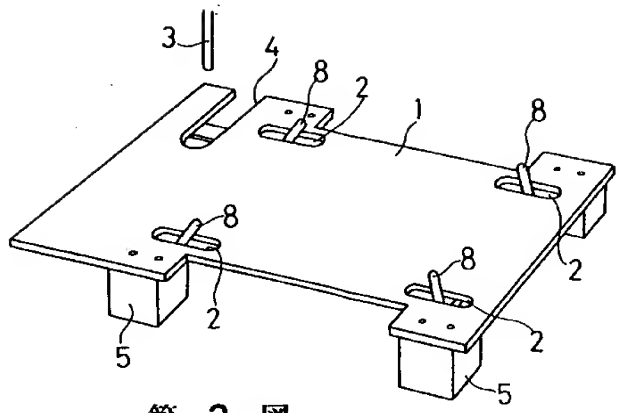
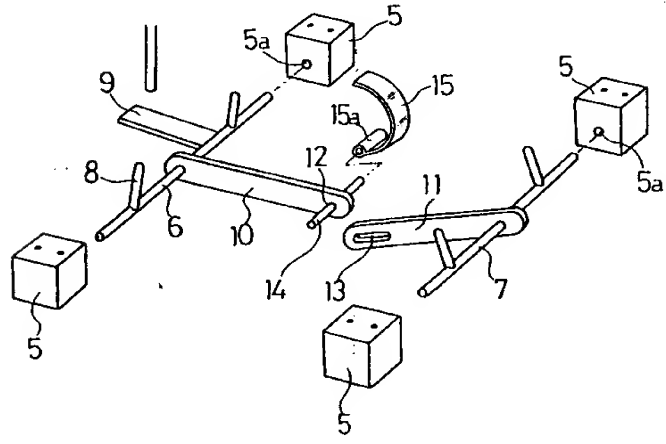
同　弁理士　小　山　　有

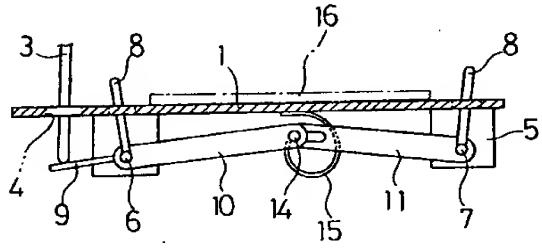
第 1 図



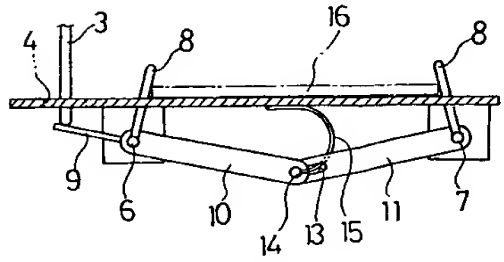
第 2 図



第 3 図



第 4 図



PTO: 2002-3926

Japanese Published Unexamined Patent Application No. 58-40837, Published March 9 1983; Application Filing No. 56-139204, Filed September 2, 1981; Inventor: Junji Kutsuzawa, et. al.; Assignee: Tokyo Ohka Kogyo Corp.

CLAMP DEVICE

[CLAIM]

A clamp device wherein a pair of shafts are provided in a freely rotating manner on the reverse surface of a mounting plate for mounting of wafers, and one of these shafts forms a rotation actuation unit, while clamping arms that project from holes formed in said mounting plate are fixed to both said shafts; levers are press fit to said respective shafts and these levers are connected, such that the shafts connected to these levers are caused to move, causing said clamping arm to be energized via an elastic member in the direction of clamping.

[DETAILED DESCRIPTION OF THE INVENTION]

The present invention concerns clamping devices that can be applied in cases of undertaking etching or development treatments on semiconductor wafers that are used in the manufacture of chips embedded with large integrated circuits for LSI or super-LSI or the like.

Various manufacturing processes, and devices therefor, for chips embedded with large-scale integrated circuits have been specified in prior art, including development of photoresist atop semiconductor wafers, spray and immersion

systems for wet etching of the surface of semiconductor wafers, and the like.

Furthermore, in recent years, the diameter of wafers has been progressively increasing so as to offer a large size and low cost, while the demand for the formation of ultra-fine patterns has accompanied high integration in super-LSI and the like. Because of this, as shown in the present applicants' previously submitted Japanese Published Unexamined Patent Application No. 55-60670 and Japanese Published Unexamined Utility Application No. 54-174906, said demands are being met by devices wherein the wafers are faced downward and continuously developed or etched.

However, if prior art clamping devices are used when the development process or wet etching is undertaken on the semiconductor wafer in said devices, there are disadvantages in that the wafers can be damaged, broken, or destroyed in a fall because the grip is not reliable. As such, unresolved disadvantages remain in semiconductor wafer clamping devices.

The present inventors took note of said disadvantages of prior art, and aim to offer a clamping device that does not cause damage, breakage, or destruction in a fall because the grip is not reliable of semiconductor wafers during development treatments or etching, and furthermore that can effect development treatments or etching in a uniform manner.

In order to achieve said aim, the present invention is characterized in that a pair of shafts, at least one of which forms a rotation actuation unit, are provided in a freely rotating manner on the reverse surface of a mounting plate for mounting of wafers, while clamping arms that project from a holes formed in said mounting plate are fixed to the respective said shafts; levers are press fit to said respective shafts and these levers are connected, such that the shafts connected to these levers are caused to move, causing said clamping arm to be energized via an elastic member in the direction of clamping.

An embodiment of the present invention will be explained hereinbelow with reference to the drawings.

Figure 1 is an overall perspective view of the clamp device of the present invention. Figure 2 is an exploded perspective view of the main portion of the same device.

Within the figures, 1 is a semiconductor wafer mounting plate; this mounting plate 1 has a flat and roughly rectangular shape. Long holes 2. . . are provided in the vicinity of the corner units thereof, such that the long diameter thereof is oriented in the direction of length of the mounting plate. Furthermore, a cut-out 4 for the purpose of allowing the actuation rod 3 to protrude is formed on one side edge.

Holding bodies 5. . . are screwed in place in the vicinity of the corner units of the reverse surface of mounting plate 1, and as shown in figure 2, a pair of axles

6 and 7 is installed so as to bridge between these holding bodies 5. . . That is to say, both end units of each axle 6 and 7 are inserted into holes 5a provided on said holding bodies 5, and held in a freely rotatable manner.

Pole-shaped clamping arms 8. . . are attached in an integral manner to both side units of axles 6 and 7. The upper halves of these clamping arms 8. . . project upward through long holes 2. . . that have been formed in said mounting plate 1. Plate-shaped rotation actuation unit 9, which is caused to rotate by means of said axle six coming into contact with actuation rod 3, is attached in an integral manner thereto. The end units of levers 10 and 11 are attached by insertion on the center units of said axles 6 and 7, and rotate in an integral manner with axles 6 and 7.

A hole 12 for insertion of a pin 14 is formed on the end unit of lever 10 that is attached by insertion onto said axle 6. Furthermore, a long hole is formed on the end unit of lever 11 that is attached by insertion onto said axle 7. The pin 14 that is inserted into hole 12 passes through this long hole 13, such that the end units of levers 10 and 11 are mutually connected to as to freely rotate.

A plate-spring 15 is inserted by fitting onto said pin 14. That is to say, plate spring 15 has the shape of a curved plate. The bottom edge unit is rolled so as to form fitting unit 15a, and this fitting unit 15a is used for the fitting of pin 14, while the top edge unit comes into

contact with the lower surface of said mounting plate 1, [such that the plate spring 15] comes to be fit in a compressed condition between pin 14 and mounting plate 1.

The end units of said levers 10 and 11 are elastically pressured in a downward direction by plate spring 15, and as a result, clamping arms 8. . . are energized in each clamping direction.

Now, the function of the clamp device with the above structure will be explained based on figures 3 and 4.

First, when mounting plate 1 is raised, the upper surface of rotation actuation unit 9 that is attached to axle 6 comes into contact with the bottom edge of actuation rod 3. As mounting plate 1 is further raised, the placement of the end unit of the rotation actuation unit 9 remains as is, such that axle 6 rotates in a counterclockwise direction as shown in figure 3, and the clamping arm 8 that is attached to axle 6 is rotated in the unclamped direction. Simultaneous with this operation, lever 10 resists the elastic force from plate spring 15 and rotates in a counterclockwise direction around axle 6. Furthermore, the end units of this lever 10 and lever 11 are connected, such that lever 11 rotates around axle 7 in a clockwise direction along with the rotation of lever 10, and this rotation causes axle 7 to rotate in a clockwise direction. Therefore, the clamping arm 8 attached to axle 7 simultaneously rotates in the unclamped direction, and comes to assume to position shown in figure 3. In said position, a semiconductor wafer

16 that has been transported by a transportation means not shown in the figure is mounted atop mounting plate 1.

Next, when the mounting plate 1 is lowered, the end units of levers 10 and 11 are pressed downward, and along with this axle 6 rotates in a clockwise direction while axle 7 rotates in a counterclockwise direction, such that the clamping arms. . . attached to these axles 6 and 7 rotate in the clamping direction, such that the semiconductor wafer 16 is held with stability as shown in figure 4.

Afterwards, with the wafer 16 held clamped as-is atop mounting plate 1, mounting plate 1 is rotated roughly 90° into an orthogonal orientation, and in this orientation, enters a development tank or etching treatment tank not shown in the drawings, and is further rotated 90° in the same direction such that the wafer is faced downwards, and treatment of the wafer is undertaken. Then, when the development treatment or the like is finished, the mounting plate is raised by reversing said operation. Actuation rod 3 comes into contact with rotation actuation unit 9, and wafer 16 is unclamped. Afterwards, the wafer is transported to a washing step or the like by a transport device.

An embodiment was explained above with drawings, but the clamp device of the present invention is not limited thereto. For example, the drawings showed an example wherein the actuation rod 3 was fixed, but the operating rod may be made to move up and down so as to actuate the clamping and unclamping of clamping arms 8. Furthermore, the drawings

showed an example wherein plate-spring 15 was used as an elastic member, but a coil-spring could be used as well. Furthermore, the number of clamping arms 8 may be selected as desired.

As clearly explained above, the present invention is such that a pair of shafts, at least one of which forms a rotation control unit, are provided in a freely rotating manner on the reverse surface of a mounting plate for mounting of wafers, while clamping arms that project from holes formed in said mounting plate are fixed to the respective said shafts; levers are press fit to said respective shafts, and these levers are connected, such that the shafts connected to these levers are caused to move, causing said clamping arm to be energized via an elastic member in the direction of clamping. Because of this, by selecting an elastic member that has the appropriate elastic force, the wafer can be held without breakage. Furthermore, because the clamping arms are always energized in the clamping direction, there is no fear of the wafer separating from the mounting plate during the development process or the like. Furthermore, because the overall device is laid out in a rational manner, the thickness thereof can be made as thin as possible, and because of this, the development process can be undertaken without accident even if the opening of the development tank or the like is narrow. As such, device exchange can be easily undertaken as well, such

the invention can be applied to semiconductor devices of various diameters and many benefits are evident.

[BRIEF EXPLANATION OF THE DRAWINGS]

The figures show a preferable embodiment of the present invention. Figure 1 is an overall perspective view of the clamp device of the present invention. Figure 2 is an exploded perspective view of the main portion thereof. Figure 3 is a cutaway view of the same device in an unclamped condition. Figure 4 is a cutaway view of the same device in a clamped condition.

1: mounting plate; 2: hole; 6,7: axle; 8: clamping arm; 9: rotation actuation unit; 10,11: lever; 15: elastic member; 16: wafer

USPTO TRANSLATIONS BRANCH

Matt Alt

July 30 2002